TIDAL BASS SURVEY
Standard Operating Procedure
2014

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This SOP will be updated at least annually or more frequently as needed

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1. Scope of the Survey

1.1 Mission of Survey

- To ensure population integrity and sustainability of tidal populations of black bass in Maryland;
- To promote and protect angling opportunities of constituents;
- To respond to public concerns of the black bass fishery in tidal freshwater rivers of Maryland with well-researched answers and awareness programs or materials.

1.2 Objectives of Survey

The objectives of the tidal bass survey are: 1) to generate indices for assessing populations of black bass (particularly largemouth bass) and habitat conditions; and 2) to report trends in these indices. During surveys, data regarding selected environmental factors and additional species collected will be recorded. These data are important for standardizing catch estimates and providing more reliable catch indices.

1.3 Period of Survey

The Tidal Bass Survey conducts a survey that targets adults and juveniles from September through October. In all cases, specific dates and times will be specified by regional managers who are leading the survey efforts. Dates may vary by weather conditions. All adult surveys should be completed prior to November, when water temperatures reach 10° C.

1.4 Rivers of Survey

There are at least 25 major tidal rivers of the Chesapeake Bay watershed in Maryland. While largemouth bass likely inhabit all of these tidal rivers, financial and time constraints prevent meaningful surveys of all of these rivers. A collaborative effort among stakeholders resulted in a ranking of 12 major tidal rivers of the Chesapeake Bay watershed. Tidal rivers were scored from 1 (do not agree) to 10 (strongly agree) for the following criteria: 1) lacks ample baseline data; 2) important as a major fishery; 3) there are perceived problems with the fishery; and 4) there is good evidence for problems with the fishery. The latter two criteria were averaged and then summed with scores for the other criteria. The total sum score was then averaged among stakeholders and ranked.

The rivers are currently ranked from highest priority to least priority as: 1) Choptank River; 2) upper Bay rivers; 3) Patuxent River; 4) Pocomoke River and Sassafrass River and Wicomico River; 5) Middle River; 6) Marshyhope Creek; 7) Bohemia River; 8) Chester River; and 9) Gunpowder River and Potomac River.

In support of the "Fishery Management Plan for Largemouth Bass (*Micropterus salmoides*)," 10 years of baseline, reference data from the survey is required for prioritized rivers. Once a 10-year reference data set is generated, it will be used as a benchmark for assessing the status of the population. The 10-year reference dataset will embody 10 years of natural variation in population dynamics, due mainly to environmental influences. For prioritized rivers, the conventional survey will at least be conducted biannually.

Rivers may be targeted to conduct a juvenile survey that is shorter in duration. During years when information for a prioritized river is needed, but sampling constraints prevent a full survey of the population, a juvenile survey may be conducted. The indices generated during the juvenile survey are not as extensive as those generated from the conventional survey. The juvenile indices include only juvenile catch and distribution among sites.

As targeted rivers for the Tidal Bass Survey change, this Standard Operating Procedure (SOP) will be updated with both the change and the justification of the change.

2. Tidal Bass Survey

2.1 General

The experimental design used to generate indices for the tidal bass survey is a stratified, random design. The strata are defined by two habitat types: prime or habitat with a high level of submerged complexity; and marginal or habitat with little or no submerged complexity. Habitats were stratified in order to improve efficiency of the survey. More effort will be directed to prime sites than marginal sites. Approximately 3-times as many prime sites should be sampled to marginal sites. The variance in catch among prime sites is greater than that for marginal sites, which necessitates a greater sample size within that stratum. The sites are randomly selected within each of the strata.

The catch estimate is the most common index used by fishery biologists to monitor populations. The index and its variance calculated from a stratified design depend on: 1) the proportion of prime and marginal habitat in the river; 2) the number of sites sampled within each stratum; 3) environmental conditions at the time of sampling; and 4) the time spent electrofishing.

2.2 Protocol for Defining Stratum Coverage

Sites were classified by habitat and stratified according to habitat type. Linear shoreline habitat for each prioritized river was divided into regions of prime or marginal habitats for tidal bass based on previous site-inspections (annually, 1999 – 2008). Marginal regions were defined as mostly downstream reaches and/or those lacking significant submerged structure and prone to significant water loss during falling or ebb tides. Prime habitats were defined as those with clear and fresh water and submerged structure. Prior analyses indicated that variance in catch estimates within the prime habitat stratum was much greater than that for the marginal stratum. As a result, the number of sites within the prime habitat stratum should be approximately three times that for the marginal stratum. This proportion should be re-evaluated each year after the survey is completed.

All potentially sampled sites have been classified using a combination of field inspections, aerial imagery, and GIS data. The habitat classifications have not appreciably changed in 10 years and are not expected to change. The same coverage within each stratum has been used since 1999. The coverage of each stratum in the river will be computed by summing up the linear shoreline distances (in meters) of sites representing each stratum.

2.3 Protocol for Choosing Number of Sites within each Stratum

Sites are randomly chosen within each habitat stratum. The number of sites that can potentially be sampled ranges from 70 (Wicomico River) to 474 (Potomac River)(Table 2.1), depending on river length, its level of branching, and extent of upriver tidal influence. Only sites within the tidal fresh reaches of the river are surveyed.

For most sites, the average number of sites surveyed for tidal rivers is sufficient for detecting a change in CPUE among years (Table 2.2). Assuming 5% type I error rate ($\alpha = 0.05$), the number of sites needed to detect a change in CPUE among assessments ($P = 0.95$) ranges from 2 to 6810 (Table 2.2). Large sample sizes are needed when there is little difference in CPUE among assessments. When sample size is prohibitively large (e.g., 6810 sites), then it must be concluded that catch has not noticeably changed among assessments and a reasonably increased sample size would not lead to a significantly different outcome.

The minimum proposed number of surveyed sites is 25, which provides a minimum standard of coverage for tidal fresh reaches. The maximum proposed number of surveyed sites is 45, which is a maximum value determined based on sampling ability within a year. The proportion of sampled area ranges from 9% to 36% across rivers, depending on length of the river and the potential number of sites, but commonly is 14% (see Table 2.1).

In the event that a pre-assigned site cannot be sampled or in situ observations indicate its change in stratum classification, then researchers may choose another site from a list of 5 alternative sites.

Table 2.1. For targeted rivers of the tidal bass survey, the average number of sites surveyed from 1999 - 2009 (Ave) and the potential number of surveyed sites (Pot). The proposed number (Prop) is subject to change.

River	**Average**	**Potential**	**Proposed**	**Proportion of Potential**
Chester	31	108	30	28%
Choptank	35	254	30	12%
Marshyhope	26	182	25	14%
Patuxent	27	162	25	15%
Pocomoke	24	184	25	14%
Potomac	44	474	45	9%
Sassafrass	28	128	25	19%
Upper Bay	28	211	30	14%
Wicomico	25	70	25	36%

Table 2.2. Power analysis to detect a change in CPUE across three sampling periods for targeted tidal rivers of the conventional tidal bass survey.

River	**CPUE (earliest assessment)**	**CPUE (prior to latest assessment)**	**CPUE (latest assessment)**	**Average SD (across assessments)**	**Sample Size Needed to Detect Change**
Chester	23.09	13.10	12.16	2.87	4
Choptank	43.00	14.76	5.27	3.49	2
Marshyhope	29.32	28.787	32.46	11.47	259
Patuxent	36.82	47.44	23.94	11.55	9
Pocomoke	29.43		29.75	5.18	6810
Potomac	90.37	113.74	107.26	12.84	10
Sassafrass	36.88		16.27	4.95	3
Upper Bay	59.98	46.33	52.01	7.54	11
Wicomico	21.65		16.67	6.67	48

2.3 Protocol for Sampling

2.3.1 General

Dates and location of sampling will be made known at least 1 month in advance of sampling so that this information can be posted on the Tidal Bass Survey website or disseminated using social networking programs. To ensure the accuracy of site coordinates, the coordinates will be screened electronically with aerial images or other spatial data by regional biologists prior to the survey.

A minimum of three researchers is required for this boat electroshocking survey. The captain will be responsible for generating float plans, piloting the vessel to georeferenced locations, helping to spot stunned black bass, and recording data. The remaining two researchers will be responsible for spotting and netting fish as they are stunned. Nets should be approximately 30 cm deep with a 2 m, fiberglass handle. Both researchers may apply electric current to the water column.

2.3.2 Environmental Conditions

Equipment needed to measure environmental variables will be checked for measurement accuracy and calibrated 1 week prior to sampling. Throughout the sampling season, water quality equipment will be calibrated once a week. All faulty equipment should be repaired prior to the next sampling day. When costly repairs or replacement units are needed, the appropriate regional manager and the tidal bass manager should be notified so that a resolution can be quickly reached. **Water quality equipment include: 1) a Yellow-Springs, hand-held meter (temperature, salinity, conductivity, dissolved oxygen, pH); 2) a Secchi disk; and 3) a GPS unit.**

Prior to sampling for fish, water quality measurements with the hand-held meter should be made at 0.3 m from surface (i.e., surface measurements). A Secchi disk measurement should be made in centimeters. The Secchi disk (20 cm in diameter) should be used between 10:00 – 2:00 pm and on a shady side of the boat[1]. It will be affected by eyesight of the viewer, contrast of the disk and surrounding water, and reflectance of disk.

The catch estimate may be corrected for effects of water quality using general linear and logistic modeling. These corrections should provide an index that is less biased by sampling or detection error.

2.3.3 Electroshocking Conditions

A common method to survey fishes is electroshocking. For riverine assessments, a boat or barge electroshocker is often used. For the Tidal Bass Survey, a boat electroshocker will be used. Boat electroshocking is not expected to survey all species or largemouth bass size classes equally well. A pulsed DC waveform will be used with a pulse rate of 60 Hz. Electroshocking should be conducted downstream when the nearshore current is

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[1] Cole, G.A. 1994. Textbook of Limnology, 4th edition. Waveland Press, Inc., Prospect Heights, Illinois.

greater than 0.5 m/s. This will prevent stunned fish from floating under the boat. When the current is less than 0.5 m/s, electroshocking may be conducted upstream. The power and current for electroshocking should be optimized for the conductivity of the water (Table 2.3). Additional testing of power density may require use of an oscilloscope prior to the field season to determine the voltage and pulse settings needed to supply enough power density to stun Largemouth Bass.

The time spent electroshocking will differ among sites, but a minimum amount of effort is spent across sites. From 1999 – 2009, the median number of shocking seconds was 253 (4.2 mins) and ranged from 63 – 1449 seconds in habitats lacking structure or significant habitat for largemouth bass (Fig. 2.2). Approximately 9% of the values were 150 seconds or less. **It is recommended to expend at least 150 seconds of shock time at a site.**

As more effort is expended in shock time for the river, the precision of the catch estimate for the river increases (Fig. 2.3)(Bonar et al. 2009). To achieve a catch estimate with a relatively high precision or low standard deviation (CV = 15%), the minimum shock time for a river is approximately 393 minutes.

While it is expected that the level of effort spent at a site may differ among sites because of logistic issues, every effort should be made to maintain consistency in sampling.

- Do not attempt to retrieve an escaped fish because that action will bias the catch per unit effort data.

- Sample every observable microhabitat, which traditionally has encompassed a shoreline of approximately 250 m. Do not target one microhabitat at the expense of another as this will bias the sample.

- Starting and ending coordinates will be provided for each site by the tidal bass manager at least 1 month in advance. These coordinates should serve as an approximate guide to orient the researchers in the presumed direction and extent of sampling, but may change depending on logistics of the sampling day.

2.3.4 Operation of Boat on Site

Sampling shall commence as: 1) a slowing of boat speed just prior to sampling; 2) the researcher at the bow should instruct the captain when sampling should begin; 3) a researcher at the bow will apply electricity to the water constantly as the boat vessel travels parallel to the shoreline, or as the boat vessel travels 1 – 3 boat lengths toward the shoreline, if surveyed using a scalloped matter (Fig. 2.4); and 4) all microhabitats within the site should be sampled with equal effort. A combination of parallel and scalloping techniques may be conducted when electroshocking is conducted as the vessel moves parallel the shoreline and when it moves toward the shoreline. In the cases where scalloping is used, the captain will be responsible for ensuring that the moves toward shore occur at equidistant increments along the stretch of surveyed stream.

Table 2.3. Target power and current for boat electroshocking in warmwater with 60 Hz pulse rate. Table adapted from Table 14.1 in Bonar et al. (2009).

	Target Power (W)		Target Current (A)	
Conductivity (µS/cm)	Min	Max	Min	Max
25	4687	5539	4.0	4.5
50	3255	3847	4.8	5.4
75	2878	3401	5.5	6.2
100	2763	3266	6.2	7.0
125	2755	3256	6.9	7.8
150	2799	3308	7.7	8.6
175	2873	3395	8.4	9.4
200	2966	3505	9.1	10.2
225	3071	3630	9.8	11.0
250	3186	3765	10.5	11.9
275	3307	3908	11.3	12.7
300	3432	4056	12.0	13.5
325	3561	4209	12.7	14.3
350	3693	4365	13.4	15.1
375	3828	4524	14.1	15.9
400	3964	4685	14.9	16.7
425	4102	4848	15.6	17.5
450	4240	5012	16.3	18.4
475	4381	5178	17.0	19.2
500	4522	5344	17.8	20.0
525	4664	5512	18.5	20.8
550	4807	5681	19.2	21.6
575	4950	5850	19.9	22.4
600	5094	6020	20.6	23.2
625	5238	6190	21.4	24.0
650	5383	6361	22.1	24.8
675	5527	6532	22.8	25.7
700	5673	6704	23.5	26.5
725	5818	6876	24.3	27.3
750	5964	7048	25.0	28.1
775	6110	7221	25.7	28.9
800	6256	7394	26.4	29.7
825	6403	7567	27.1	30.5
850	6550	7740	27.9	31.3
875	6696	7914	28.6	32.2
900	6843	8088	29.3	33.0
925	6990	8261	30.0	33.8
950	7138	8435	30.7	34.6
975	7285	8609	31.5	35.4
1000	7432	8784	32.3	36.2
1050	7727	9132	33.6	37.8
1100	8023	9482	35.1	39.5
1150	8319	9831	36.5	41.1
1200	8615	10181	38.0	42.7
1250	8911	10531	39.4	44.3

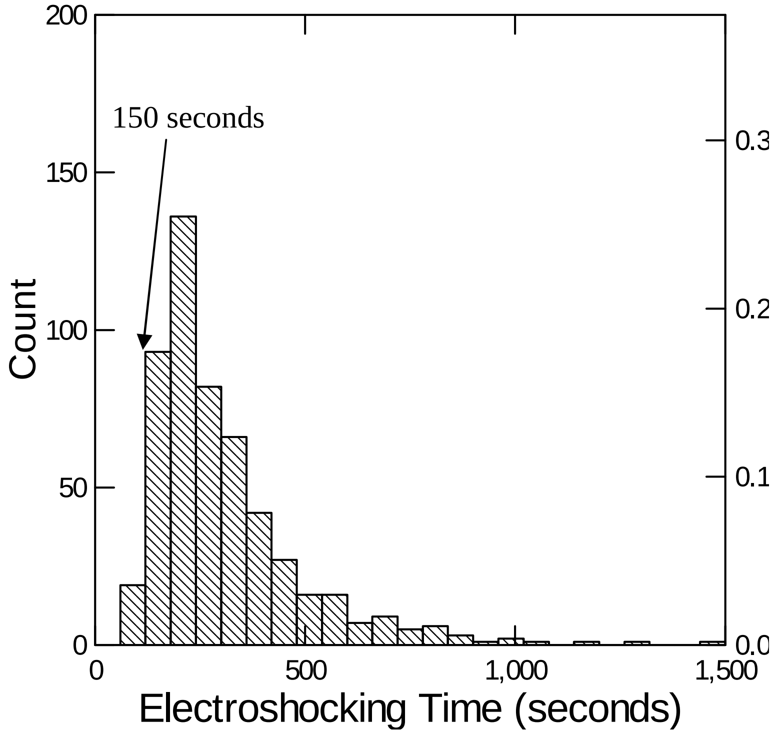

Figure 2.2. Histogram of electroshocking time (in seconds) spent in marginal habitats during the conventional survey (1999 – 2009).

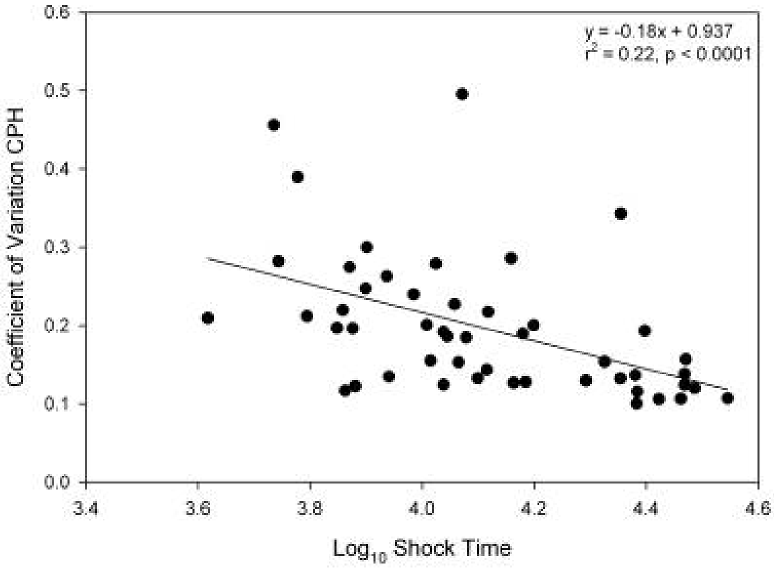

Figure 2.3. The coefficient of variation (CV) in the catch per unit effort or hour (CPH) of tidal bass versus seconds spent electroshocking for each targeted river (labeled points) and year of the conventional survey (1999 – 2009).

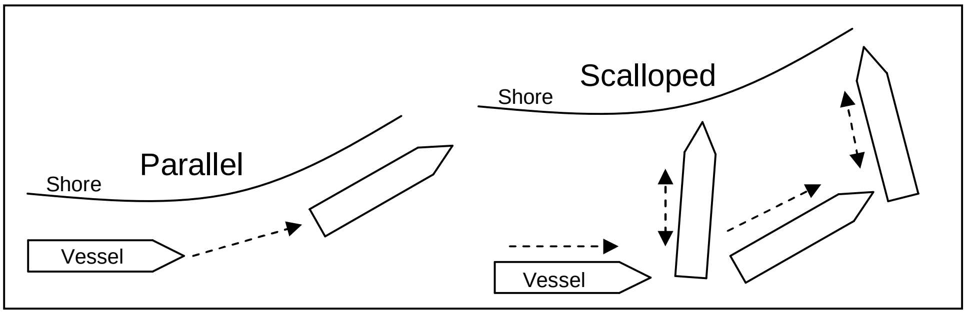

Figure 2.4. Figure depicting two sampling methods utilized by the tidal bass survey. Parallel surveys are defined by times when electroshocking is conducted while the boat vessel is moving parallel with the shoreline. Scalloped surveys are defined by times when electroshocking is conducted while the boat vessel moves 1 – 3 boat lengths toward the shoreline.

2.4 Protocol for Handling Procedures

When black bass are stunned by the electroshocking boat, they should be quickly transferred to an oxygenated (near or above 100% oxygen saturation), re-circulating holding tank. Temperature and dissolved oxygen of the water in the holding tanks should be monitored regularly to ensure ambient, oxygenated water is provided the tidal bass.

Most specimens will be measured for total length (in millimeters) and weighed (in grams) before being returned to the site from where they were taken. Each fish will be inspected for lesions or injuries that will be recorded. When a tagged fish is encountered, then the tag number will also be recorded. For largemouth bass collected from some rivers where coded wire tagged largemouth bass have been released (currently, Choptank River and Patuxent River), then the fish will be scanned to determine presence of the tag. In some cases, it may not be possible to obtain a weight. In those cases, the fish will be released following its length measurement; “NA” will be recorded for the weight measurement.

At the discretion of the tidal bass manager and regional managers, a small random sample of individuals may be sacrificed for life history information, beginning in 2009 (Table 2.4). This random sample will not exceed 25 individuals per river in a year. A maximum of 5 individuals from discrete size classes (Table 2.5) sampled within each river may be taken. The first 5 individuals meeting the length requirements will be sacrificed. Sacrificed individuals will be measured, weighed, placed in a bag with a waterproof label detailing river and date, and euthanized by chilling or freezing.

Other species collected will be identified and noted on datasheets. A whiteboard at the bow and/or a digital voice recorder will be necessary for netters to record species as they are encountered. At the discretion of the regional managers, counts of particular species may be additionally required.

2.5 **Protocol for Handling Atlantic Sturgeon**

According to Biological Opinion (Section 11.3) issued by NMFS to U.S. FWS regarding the handling of the endangered species Atlantic Sturgeon[2], the following shall be performed:

1. For electrofishing, no sturgeon over 2 feet in length shall be netted. All observations of netted sturgeon must be reported to NMFS as required… All observations of non-netted sturgeon should also be reported to NMFS via e-mail (incidental.take@noaa.gov), as soon as practicable. This report must contain the date, location, tentative species identification, and approximated size of the fish.
2. If the sturgeon comes in contact with sampling gear, all electrofishing must cease for 5 minutes or until the fish is observed to recover and leave the area.

Table 2.4. Proposed number of largemouth bass (*Micropterus salmoides*) to sacrifice for surveyed rivers.

River	**Samples**
Chester	NONE
Choptank	10, only those < 310 mm TL
Nanticoke	25
Patuxent	NONE
Pocomoke	25
Potomac	10, only those < 310 mm TL
Upper Bay	25
Sassafrass	NONE
Wicomico	NONE

Table 2.5. Size classes of largemouth bass (*Micropertus salmoides*) for life history work. Classes loosely correspond to ages 0 – 5+.

Lower Bound	**Upper Bound**
150	200
201	304
305	375
376	393
394	434
435	450

2 http://www.nero.noaa.gov/protected/section7/bo/actbiops/usfws_state_fisheries_surveys_2013.pdf

3. Data Collection and Disposition

3.1 Protocol for Data Collection

Prior to collecting data, all researchers participating in the survey should be made fully aware of the information they are recording and how that information is obtained. **Researchers will collect data in a consistent and uniform manner, using similar gear.** A meeting prior to sampling events may be necessary for ensuring quality of the data collection.

All data should be recorded using pencil on waterproof paper. For consistency, all tidal bass surveys will use the datasheets in the Appendix of this document. Electronic versions are available on the common network drive, J:/Inland fisheries/tidal bass.

3.2 Protocol for Data Disposition

Following data collection, all data sheets will be collated and scanned to *.pdf files. A scanned file will contain all data sheets for a river and for a year. **The electronic file will be named by river and year and will be stored at the common network drive,** J:/inland fisheries/tidal bass drives.

Original data sheets will be stored at the regional office with whom the survey was conducted. No data sheets will be discarded until all sheets have been scanned and the scanned copy, checked by at least two researchers. No data sheets will be discarded without notifying the regional managers.

3.3 Protocol for Data Entry

Data will be entered into a relational, archival data base. This database is currently called GIFS. The regional office responsible for the survey will administer the entry of data into the relational, archival data base.

Data will be exported from GIFS and appended to a Microsoft Excel spreadsheet that is currently stored on J:/inland fisheries/tidal bass.

3.4 Protocol for Quality Assurance/Quality Control Procedures

Data entered into the archival database (or GIFS) will be cross-checked by a second researcher. Pass data will be checked against those presented on the data sheet. Corrections will be made to the pass data in the archival data base.

Data exported from the archival database to a worksheet will be checked for errors. The minimum and maximum values will be determined for variables within the worksheet. Additional procedures, such as scatterplots, may also be employed for determining errors.

When discovered, errors will be cross-referenced with recorded data to datasheets. Corrections will then be made to the spreadsheet and the archival database.

The number of fish caught during a survey will be plotted by effort. The expected, positive relationship will be evaluated for each dataset. A catch datum that is low relative to effort for the relationship will be considered an outlier. These outliers will be removed from the average catch estimate, but noted in subsequent reports, such as the Federal Aid Report.

The length-weight relationship will be evaluated using a scatterplot. Outliers will include those data points that deviate significantly from the global, length-weight relationship. When an outlier is discovered, the values will be cross-checked with datasheets to determine if mass or length were recorded in units different from those generally used (i.e., grams, millimeters). When necessary, data will be corrected on the spreadsheet and archival database.

4. Common Sense Provision

Safety of researchers and living organisms supersedes the desire for quality or robust data. Field ecology is challenged by changing environmental conditions, perception and background of the researchers, and “demonic intrusion” or unpredictably, maligning events. The best defense against challenging conditions is common sense. When an event arises that challenges the traditional collection of data, then researchers should collectively choose the best course of action by weighing ramifications of such a choice against the act of doing nothing. Researchers are held accountable for their actions and the data they collect. The highest standard of scientific ethics is expected.

APPENDIX

Tidal Bass Survey

Collector* Initials______
* Collector is the person recording the data

Date: _____/_____/_____
River: ______________________________
Site Number: _______________________
Site Description ___________________

Tidal Stage:
☐ High Ebb ☐ High Flood
☐ Med Ebb ☐ Med Flood
☐ Low Ebb ☐ Low Flood
☐ High Slack ☐ Low Slack

Weather:
☐ Cloudy
☐ Overcast
☐ Rain
☐ Sunny
☐ Windy

Start Time: _____________ Stop Time: ____________
Start Lat ____ _____._____ Stop Lat ____ _____._____
Start Long ____ _____.____ Stop Long____ _____.____
Site Length __________ (m) Scalloped ___ Parallel ___
Site Width _______ (boat lengths)
Electrofisher: Electrofishing Duration: ______ (seconds)
Voltage: ____ High ____ Low ______Amps (mean value)
Pulse Rate: ________ Percent of Range: ________

Bank Vegetation (Check if present):

Agriculture ____ Grass/Urban ____ Woody Veg. ____ Wetland____ Dev/Paved ____ Beach ____ Riprap _____

In-Stream Habitat: (Check if present):

Ledge/Drop-off ______Gravel/Boulders_____Brush/Logs ______Pier/Bulkhead _____Wreck/Barge ______Mudflat ______

Aquatic Vegetation (AV) Coverage in Sampling Area: (0 – 100%, 5% increments)

% Algae ________ % SAV ________ % Emergent ________ AV density (check one): ____dense ____med. ____sparse

List common AV species (if known): ____

Water Quality (WRITE IN UNITS):

MinDepth ___________ MaxDepth ___________ Wat Temp: _________DO ___________ Spec. Cond. ___________

Cond. ___________ pH ___________ Secchi Depth: ___________ Sal. ___________

Largemouth Bass Data (WRITE IN UNITS):

Fish #	TL (__)	Wt (__)	Tag?	Tag #	Lesion	Severity	Other
1			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐HEM ☐ULC ☐TUM	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPHD ☐OCAT ☐OPOP
2			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐HEM ☐ULC ☐TUM	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPHD ☐OCAT ☐OPOP
3			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐HEM ☐ULC ☐TUM	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPHD ☐OCAT ☐OPOP
4			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐HEM ☐ULC ☐TUM	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPHD ☐OCAT ☐OPOP
5			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐HEM ☐ULC ☐TUM	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPHD ☐OCAT ☐OPOP
6			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐HEM ☐ULC ☐TUM	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPHD ☐OCAT ☐OPOP

Other Species	Cnt (R / A)	Other Species	Cnt (R / A)

Survey Notes
Number of Individuals Kept:_______
Number of Returned, Moribund Individuals: ________
Additional Comments:

Bass were generally caught:

Throughout habitat ____ In specific habitats (list as noted above):____

(backside)

Fish #	TL (__)	Wt (__)	Tag?	Tag #	Lesion	Severity	Other
7			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
8			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
9			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
10			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
11			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
12			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
13			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
14			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
15			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
16			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
17			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
18			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
19			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
20			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
21			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
22			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
23			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
24			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
25			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
26			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
27			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
28			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
29			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
30			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
31			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
32			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
33			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
34			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
35			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
36			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
37			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
38			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
39			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT
40			☐SCAN ☐PIT ☐FLOY ☐CWT		☐ABR ☐NEC ☐TUM ☐HEM ☐ULC	☐MIL ☐FOC ☐MSEV ☐MFL	☐OPSD ☐OEMA ☐OPOP ☐OPHD ☐OCAT

Tidal Bass Survey Fish Health Definitions and Abbreviations

ABR Abrasion. A fresh mechanical wearing away or roughening of the scales and skin. Caused through handling, nets or other mechanical sources.

HEM Hemorrhagic. Abnormal discharge of blood into tissues, into or from the body; the escape of blood from the vessels, bleeding under scales of skin or fins.

NEC Necrotic. Death of areas of cells and tissues [tissues] appear firm and pale, as if cooked.

ULC Ulcer. An excavation or penetration, generally round in shape, through the skin into the muscle or abdominal organs.

TUM Tumor. A swelling or enlargement. A spontaneous new growth of tissue forming an abnormal mass.

OSPD Spinal Deformity. Obvious twisting of the body, can be either side to side or top to bottom.

OPHD Physical Damage. Other anomalies on fish caused by external agent (hook wound, bird pecks, fish bites, gear damage). Includes scars, missing eyes, and damaged fins.

OEMA Emaciated. State of being extremely lean.

OCAT Cataract. Opacity of the lens of the eye.

OPOP Pop Eye. Abnormal protrusion of the eyeball.

MIL Mild. The infection or anomaly is superficial, not penetrating.

MSEV Moderate or Severe. The anomaly or infection penetrates the scales, is bloody, or deeply penetrates skin and exposes organ.

FOC Focal. A very localized, discrete area of alteration.

MFL Multifocal. More than one (many) localized, discrete areas of alteration.